

LA-UR-19-22088

Approved for public release; distribution is unlimited.

Title: Explosives Storage

Author(s): Lloyd, Joseph Marvin

Intended for: OIG Audit

Issued: 2019-03-08

Disclaimer:

Los Alamos National Laboratory, an affirmative action/equal opportunity employer, is operated by Triad National Security, LLC for the National Nuclear Security Administration of U.S. Department of Energy under contract 89233218CNA000001. By approving this article, the publisher recognizes that the U.S. Government retains nonexclusive, royalty-free license to publish or reproduce the published form of this contribution, or to allow others to do so, for U.S. Government purposes. Los Alamos National Laboratory requests that the publisher identify this article as work performed under the auspices of the U.S. Department of Energy. Los Alamos National Laboratory strongly supports academic freedom and a researcher's right to publish; as an institution, however, the Laboratory does not endorse the viewpoint of a publication or guarantee its technical correctness.

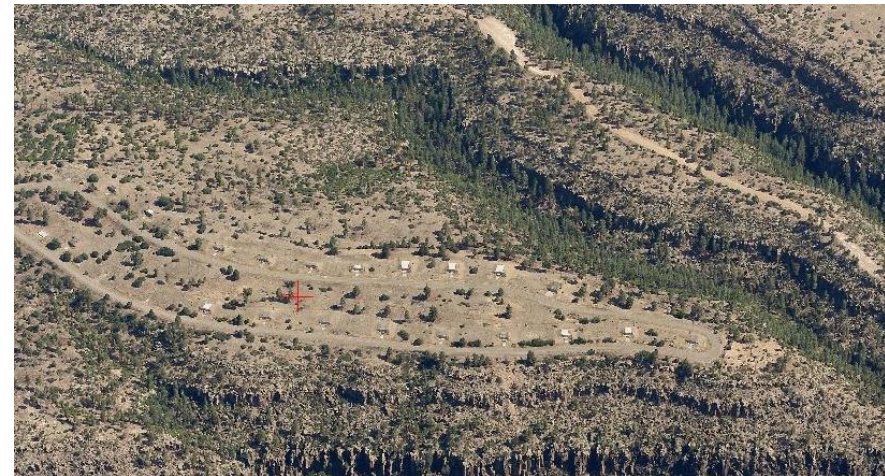
Explosives Storage



LANL Explosives Safety Program Owner: Mike Lake
Explosives Facilities Siting and Construction: Ken Gillespie
Authority Having Jurisdiction: Joe Lloyd

February 4, 2019

LOS ALAMOS
EXPLOSIVES SAFETY



Managed by Triad National Security, LLC for the U.S. Department of Energy's NNSA

Explosives Safety Site Plans

- **Existing Explosives Safety Site Plans (ESSPs)**

- 138 locations with active ESSPs
 - 49 Operating Locations (laboratory operations, machining, assembly...)
 - 67 Active **Storage** Locations (Above Ground Magazines)
 - 14 Disposal Ranges (Firing Sites, Gun Operations)
 - 4 Waste Disposal Facilities (Burn Pad, Burn Tray, and Filter Beds)
- No active storage facilities exist without a current ESSP
- One preliminary ESSP pending funding of above ground storage facility at TA-16

- **Site Planning Process**

- ESSPs are drafted by the Explosives Safety Program Office with input by the user
- Formally submitted to Los Alamos Field Office for approval
- Once approved, posted on internal Explosives Safety Program webpage

Active Storage Facilities and Load Limits

Technical Area 9

TA-9-22	25
TA-9-23	72
TA-9-24	72
TA-9-25	78
TA-9-26	78
TA-9-27	72
TA-9-36	650
TA-9-39	520
TA-9-40	570
TA-9-44	610
TA-9-47	560
TA-9-49	470
TA-9-51	120,066
TA-9-53	9,261
TA-9-55	16,140

Technical Area 14

TA-14-22	280
TA-14-24	5
TA-14-30	21

Technical Area 15

TA-15-43	21,000
TA-15-241	160
TA-15-243	490

Technical Area 16

TA-16-261	4,600
TA-16-263	3,400
TA-16-265	3,200
TA-16-267	2,900
TA-16-308	4,300
TA-16-413	3,900
TA-16-415	6,600

Technical Area 22

TA-22-7	420
TA-22-8	270
TA-22-9	90
TA-22-10	60
TA-22-18	2,100
TA-22-96	180
TA-22-172	2,000
TA-22-173	425

Technical Area 36

TA-36-10	18,600
TA-36-83	18,600

Technical Area 37

TA-37-4	30,200
TA-37-5	17,900
TA-37-7	18,600
TA-37-10	15,000
TA-37-11	16,900
TA-37-12	16,900
TA-37-13	17,200
TA-37-14	37,500
TA-37-15	115,000
TA-37-18	38,700
TA-37-21	36,400
TA-37-22	37,000
TA-37-23	37,500
TA-37-24	37,500
TA-37-25	42,800
TA-37-26	48,600

Technical Area 39

TA-39-3	2,700
TA-39-5	740
TA-39-77	5,800

Technical Area 40

TA-40-2	780
TA-40-7	21
TA-40-10	22
TA-40-13	477
TA-40-14	477
TA-40-36	4,600
TA-40-37	4,600
TA-40-38	2,500
TA-40-39	1,100

Technical Area 49

TA-49-145	1500
-----------	------

Explosives Safety Site Plans (cont.)

- **ESSP History**

- Bulk of ESSPs were generated by A-P-T Research in 2009 using ASHS

- Neil Boddicker visited in May, 2017 for 2 days to discuss

- All Quantity-Distance (QD) requirements met

- Distances shown in ESSPs are typically the basic K-factors and assume the potential explosion sites (PESs) and exposed sites (ESs) are in the open without additional protection such as facility hardening, earth coverings, or barricades

- Inhabited Building Distance (IBD) K40

- Public Traffic Route Distance (PTRD) K24

- Intraline Distance (ILD) K18

- Intermagazine Distance (IMD) K11

Explosive Material Limits

- **Storage facilities are distributed across the Weapons Facilities Operations (WFO)**
 - Explosives limits generally range from tens of pounds to over 100,000 pounds
 - Limits based on quantity-distance requirements
- **High Explosives Inventory Database (HEIDi) warns users at 85% capacity**

Explosives Magazine Refresh Project

- **Many structures constructed circa 1950 and aging**
 - Original design implements compliant blast-resistant features
 - Sound, functional construction receiving timely refurbishment
- **Numerous unneeded storage facilities shutdown and scheduled for D&D**
- **Comprehensive upgrade program is scheduled to begin in 2019**
 - Involves approximately 59 existing magazines
 - Scope of work includes repairing and replacing:
 - Doors
 - Pavement and concrete
 - Loading docks
 - Earthwork including cover
 - Lighting
 - Asbestos removal
 - Flooring
 - Shelving
 - Lightning protection systems (LPS)
 - Historic preservation

On-Site Hazard Classification

- **Hazard Classification (HC) and Storage Compatibility Group (SCG) are assigned in accordance with DOE-STD-1212, Ch II-17.4**

- When materials are received with a conflicting DOT designation they may be re-categorized by operating personnel

- LANL Explosives Review Committee (ERC)
- Magazine custodians
- Firing Site Leaders
- Experimenters
- On-site explosives transport personnel

**A DOT explosive HC does not have to be changed to meet the DOE definition to be placed in storage*

- Newly synthesized materials follow the High Explosives Development (HED) process overseen by the ERC

- Guidance is provided for HC and SCG assignment in certain configurations in P101-8, Att. A

- All other changes to HC or SCG may only be authorized by the on-site classification authority or the Authority Having Jurisdiction (AHJ)

- Two qualified persons at LANL
 - AHJ and 49CFR SME

Explosives Inventory Retention

- **LANL explosives inventory requires each explosive item in storage to have a programmatic/technical owner as well as a storage review date**
 - Goal is to reduce inventories to those that can be programmatically justified at LANL
- **Storage magazines must be inventoried *at least* annually to verify the total weight of explosives present**
 - Ensures that weight conforms to allowable QD constraints
 - Opportunity to properly label materials not properly labeled
 - Remove for disposition those materials:
 - Not properly identified or labeled
 - Without programmatic justification
- **Service magazine inventory should be reviewed every three months**
- **Responsibilities**
 - Owner of stored explosives
 - Expected to justify the retention of material on annual basis
 - Must be familiar with retention policy in P101-8
 - Line manager
 - Evaluate proposed retention of stored material based on guidelines in P101-8
 - Must be familiar with retention policy in P101-8
 - Ensures material(s) are transferred to another owner when personnel move organizations or leave LANL
 - Provide concurrence for the retention of explosives by review or approval of their annual inventory

Explosives Inventory Retention (cont.)

• Guidelines for retention

–Owner

- Confirms explosives quantities and types are accurate
- Annually, or more frequently where required, review database and update justification for retention or declare excess
- Dispose of or remove to an appropriate storage magazine any material that has been in the service magazine for a period approaching 180 days, and is not expected to be used immediately
- Recommend retention or destruction based on the information in the inventory as well as the following considerations:
 - How long the material has been stored
 - Condition of explosives
 - Historical usage information (tempo/cadence of usage)
 - Stability/storage review data (see Storage/Stability Review)
- Pass recommendations to management for concurrence
 - Ensure items marked for disposal are properly identified

–Line manager

- Notifies owner of results of management review

–Owner

- Responsible for carrying out the appropriate disposition in timely manner

Storage Review Program

- **Explosives Storage Review Committee**

- with the concurrence of the ERC, establishes the storage review program for the institution

- **Storage Review Period**

- The ERC has approved storage review periods for material listed on the Allowed Energetics Material List available on the Explosives Safety website

- **Storage Review Date**

- The storage review date of a newly manufactured, consolidated part is determined by adding the storage review interval of the source material (e.g., 20 years in the case of PBX 9501) to the latest date of material manufacture, pressing, and/or processing, or to the latest stability test date, whichever is later
 - Where there is uncertainty about extending the storage review date for a given material, the Explosives Storage Review Committee must be consulted for guidance
 - The storage review date for a mixture or blend (formulation) of two or more energetic materials must be the same as that for the material with the earliest storage review date
 - If testing shows the formulation to be less stable than the least-stable component, a shorter interval and a new date must be established
 - The storage review date must be given in the HE Inventory Database and on the explosives identification label on every container or package of energetic materials in use or in storage
 - Materials that are kept in storage after their storage review date is reached should not be used and should be segregated appropriately until necessary evaluation is completed
 - If there is a need to use energetic materials whose storage review date has expired without testing, the ERC must review the conditions for use and such use must be approved by the ERC Chair

Storage Review Program (cont.)

- **General material-specific guidelines are provided for energetic materials**
 - Bulk powders
 - Commercial explosives
 - Consolidated explosives
 - Detonators/assemblies
 - Gun powders and propellants
 - Fuel oil compositions/ANFO
 - Liquid explosives
 - Stabilized energetic materials
- **Modification of review period**
 - Generally not modified
 - Must be approved by ERC
- **Modification of review date**
 - Extended by lot or batch
 - Extensions for stabilized materials not applicable by lot or batch without sufficient information
 - After purification of a material if the stabilizer level is reestablished
 - Date of purification becomes the new date of manufacture
 - Review period remains the same
 - The ERC must review the new stabilizer content data to determine if the storage review date should be extended for stabilized materials
 - The ERC Chair gives final approval

Storage Review Program (cont.)

- **Bulk propellants surveillance**

- For bulk propellants and/or nitrate esters in storage, it is advisable to perform an annual screening test using methyl violet paper to determine if there is formation of nitrogen oxide (No_x)
 - A strip should be packaged with the material when opened
 - If a color change is observed on the methyl violet paper during a review, a quantitative measurement should be taken promptly to determine the amount of the remaining stabilizer in the propellant

- **Desensitized Energetic Materials**

- Control of the amount of desensitizer present is critical to the safe handling of these materials
- Wetting agent should be present in concentrations ranging from 15 to 25% by weight of wetting agent, depending on the explosive
- Wetting agent should consist of 1:1 water/ethanol mixture to prevent freezing during winter months while in storage

- **R2A2 found in P101-8, Att. C**

- Custodian
- Owner
- Synthesizer or formulator
- Explosives worker
- ERC Chair
- Line managers/supervisors
- Explosives Storage Review Committee

DOE Explosives Safety Committee

- **Conduct monthly assessments with LAFO**
 - Explosives safety engineer (Bernard Whitaker)
- **Attend semiannual Explosives Safety Committee (ESC) meetings**
 - AHJ is voting member
 - Currently leading the only three task groups
 - Level-of-Protection (LOP) requirements
 - Critical temperatures and heating
 - Machining
 - Cutting and lathing speeds
- **Continually seeking networking opportunities**
 - AHJ and QD/LOP SME Attended 2018 International Explosives Safety Symposium and Exposition
 - Hosted by National Defense Industrial Association (NDIA) and co-host, DoD Explosives Safety Board
 - Attended by Chair of DOE ESC